



GEOPROC

The 5th International Conference on Coupled
Thermo-Hydro-Mechanical-Chemical (THMC)

Processes in Geosystems: Petroleum and
Geothermal Reservoir Geomechanics and
Energy Resource Extraction

February 25-27, 2015

Conference Organizers



Sanctioning Bodies



Welcome

On behalf of the organizing committee, we welcome you to GeoProc 2015 in Salt Lake City, Utah. This event, as part of the GeoProc conference series, is the first time the meeting has been held in North America. We look forward to maintaining the tradition of the GeoProc conference series being small and focused, yet drawing input from a diverse audience. The conference theme "Coupled Thermo-Hydro-Mechanical-Chemical (THMC) Processes in Geosystems: Petroleum and Geothermal Reservoir Geomechanics and Energy Resource Extraction" was designed to bring scientists and engineers together from different backgrounds to address common scientific issues for a wide range of natural and engineering phenomena in energy resource extraction. These phenomena include what until recently were considered "emerging", but are becoming mainstream, such as enhanced oil and gas recovery, hydraulic fracturing, and enhanced geothermal systems. However, more traditional fields such as nuclear waste disposal and CO₂ geological sequestration have also been included. Although each phenomenon may have its own characteristics, a number of common scientific issues remain same and we look forward to discussing them at GeoProc.

The goal of this event is to seek understanding and find solutions for coupled thermal-hydro-mechanical-chemical problems observed in petroleum and geothermal reservoirs. Advancements toward these goals will be achieved over the next few days through several keynote lectures, over 30 specialized technical presentations, and active interactions among researchers. All lectures and papers will be published in on-line proceedings and selected ones will be published in a special theme issue of a selected journal.



Multiscale Modeling on Multiscale Computers

James C. Sutherland, The University of Utah

Abstract:

Multiphysics processes frequently involve a wide range of length and time scales that are coupled nonlinearly. Simulating such processes is challenging due to the complexity of the physics, complexity of the computer architecture, and the vast range of scales present. This talk addresses two extremes in this context. First, we discuss extreme-scale computing and present some techniques and abstractions that enable developers to be productive in solving highly coupled multiphysics problems on emerging architectures (hundreds of thousands of processing elements). Second, we discuss techniques for model reduction for high-fidelity, low-cost modeling of complex systems suitable for calculation on desktop-scale computers.

Bio:

Professor Sutherland is an Associate Professor of Chemical Engineering and adjunct Associate Professor in the School of Computing at the University of Utah. Dr. Sutherland's research is in the nexus of turbulent reacting flow, numerical analysis and high-performance computing, with applications in Large Eddy Simulation, Direct Numerical Simulation and reduced order modeling of turbulent combustor flows. Prior to joining the University of Utah's faculty, he was a post-doctoral researcher at Sandia National Laboratories, where he developed models and software for simulating objects in pool fires. Dr. Sutherland enjoys spending time with his family backpacking and boating.



Fracture Network Assessment of Unconventional Reservoir Production and Enhanced Geothermal Systems

Thomas Doe, Golder Associates, Redmond WA

Abstract:

Assessments of unconventional oil and gas and enhanced geothermal energy development have relied on simplified fracture networks. This presentation will look at the roles of natural fractures in controlling hydraulic fracture growth and then consider their effects on both fossil fuel and geothermal development. Examples of oil and gas production from West Virginia and Texas's Eagle Ford Shale show that fracture complexity and heterogeneous block sized have distinctive effects on production. Similar generic fracture networks also were studied to look at the influence of fracture heterogeneity on thermal production from an enhanced geothermal reservoir. Inspection of analytical solutions shows that thermal breakthrough depends on the second power of area and flow rate. Concentrating flow in smaller portions of heterogeneous networks may complicate EGS development.

Bio:

Dr. Thomas Doe is a principal at Golder Associates in Redmond WA where his areas of specialization are fluid flow and geomechanics of fractured rock. Tom has degrees in Geology and Mineral Engineering from Pomona College and the University of Wisconsin-Madison. He has taught engineering geology and hydrogeology at UW and Pomona College and has held adjunct positions in Civil Engineering at the University of California-Berkeley and in Petroleum Engineering at the University of Utah. He is past president of the American Rock Mechanics Association and former member of the National Academy of Science's Committee on Geological and Geotechnical Engineering.

Wednesday, February 25, 2015

6:00 PM **Welcome and Registration** **Rob Podgorney**
Heavy hors D’oeuvres will be served Idaho National Laboratory
(Atrium)

Thursday, February 26, 2015

8:00 AM **Registration**
(Atrium)

8:20 AM **ISRM Introductory Message** **Sérgio Fontoura**
(Amphitheater) Catholic University of Rio de Janeiro
Chairman, ISRM Commission on
Petroleum Geomechanics

8:30 AM **Opening Welcome** **Klaus Regenauer-Lieb**
(Amphitheater) University of New South Wales

Session 1: Heavy Oil and Oil Shale

9:00 AM *A Thermoplasticity Model for Oil Shale* **Alan Burnham**

9:20 AM *Application of Reservoir Flow Simulation with Different Fracture Geometries to Improve Hydraulic Fracture Well Performance in Tight Oil Play* **Menglu Lin**

9:40 AM *Thermally-stranded high pour point oil in the Uinta Basin, Utah* **Steven Schamel**

10:00 AM **Morning Break**

Session 2: CO2 and Carbonates

10:20 AM *Carbonate fault reactivation as a THMC instability* **Manolis Veveakis**

10:40 AM *Numerical Modeling Study of CO2 Storage in Brine Aquifer in Ferric Iron-Bearing Sandstone* **Luanjing Guo**

11:00 AM *Effect of Reservoir pH on a Novel Stimuli-Responsive/Rheoreversible Hydraulic Fracturing Fluid* **Carlos Fernandez**

11:20 AM *Application of supercritical CO2 in enhanced geothermal system: Calibration of kinetic rates from batch experiments* **Feng Pan**

11:40 AM *Design of CO2 -Plume Geothermal (CPG) subsurface system for various geologic parameters* **Nagasree Garapati**

12:00 PM **Hosted Lunch** **James Sutherland**
(Ballroom) University of Utah

Session 3: Computational Methods

1:00 PM *INL MOOSE* **Andrew Slaughter**

1:20 PM *REDBACK: an Open-Source Highly Scalable Simulation Tool for Rock Mechanics with Dissipative Feedbacks* **Thomas Poulet**

1:40 PM *Modeling coupled Thermo-Hydro-Mechanical processes including plastic deformation in geological porous media* **Sharad Kelkar**

2:00 PM *XFEM-Based CZM for the Simulation of 3D Multiple-Stage Hydraulic Fracturing in Quasi-brittle Shale Formations* **Mahdi Haddad**

Thursday, February 26, 2015Continued

2:20 PM	<i>A WENO reconstruction based Discontinuous Galerkin Method for Transport in Heterogeneous Media</i>	Yidong Xia
2:40 PM	<i>Coupled THMC models for bentonite in clay repository for nuclear waste: illitization and its effect on stress under high temperature</i>	Liangge Zheng
3:00 PM	Afternoon Break	
	Session 4: Shale Gas	
3:20 PM	<i>THMC instabilities in high temperature/ pressure diagenesis of shale gas reservoirs</i>	Klaus Regenauer-Lieb
3:40 PM	<i>Effects of Reservoir Temperature and Applied Pore Pressure on the Pore-Scale Imbibition in Shales</i>	Gorakh Pawar
4:00 PM	<i>Modeling and Simulation of Multiscale Transport Phenomena in Shale Reservoirs</i>	Jan Goral
4:20 PM	<i>A Peridynamic Simulation of Hydraulic Fracture Phenomena in Shale Reservoirs</i> Siavash Nadimi	Siavash Nadimi
4:40 PM	<i>Proppant Embedment into Fracture Rock Walls; Experimental and Modeling Results</i>	Earl Mattson
5:00 PM	Facilitated Discussion Heavy hors D’oeuvres will be served	Rob Podgorney Idaho National Laboratory
6:30 PM	Adjourn	

Friday, February 27, 2015

7:50 AM	Opening Remarks and Daily Agenda (Amphitheater)	Milind Deo University of Utah
	Session 5: Fracturing	
8:00 AM	<i>Hydraulic Fracture Design in Heterogeneous Formations</i>	Ahmad Ghassemi
8:20 AM	<i>Prediction of fracture initiation pressure and fracture geometries in elastic isotropic and anisotropic formations</i>	Han Li
8:40 AM	<i>Simulation of Hydraulic Fracture Propagation in Heterogeneous Reservoir based on a Dual-Lattice Discrete Element Method</i>	Jing Zhou
9:00 AM	<i>Dynamic Analyses of Slip Along a Natural Fracture Activated by Hydraulic Fracturing Treatment and Governed by a Slip-Weakening Frictional Law</i>	Zhenhua He
9:20 AM	<i>Numerical modelling of massive fluid injection in thermo-poro-mechanical systems</i>	Ali Karrech
9:40 AM	Morning Break	
	Session 6: Geothermal Systems and Miscellaneous Topics	
10:00 AM	<i>Modeling the Thermo-Hydro-Mechanical Response of Enhanced Geothermal System with Pre-existing Discrete Fracture Network</i>	Jason Furtney
10:20 AM	<i>Analysis of the Thermal and Hydraulic Stimulation Program at Raft River, Idaho</i>	Jacob Bradford

Friday, February 27, 2015Continued

10:40 AM	Tomographic Fracture Imaging and GeoCritical Reservoir Models for Smart Drilling and Stimulation of Non-Conventional and Engineered Geothermal Systems	Peter Geiser
11:00 AM	Assessment of a Finite Element Simulation Code for a Series of Geothermal Benchmark Problems	Yidong Xia
11:20 AM	Probing Pore Dynamics in Low-Permeability Formations for Energy Exploration and Storage: A Small-Angle Neutron Scattering Study	Sharad Kelkar
11:40 AM	Signatures and Interpretations of Pump-in and Flow-back Tests in High Permeability and Low Permeability Formations	Yongcun Feng
12:00 PM	Computational modeling of load transfer mechanism in heat exchanger pile	Tri Tran
12:20 PM	Hosted Lunch with Keynote (Ballroom)	Tom Doe Golder Associates Inc.
1:20 PM	Closing Remarks (Ballroom)	John McLennan University of Utah
1:30 PM	Adjourn	
2:00 PM	TerraTek - Tour of Reservoir Laboratories (Optional) Limited to 25 attendees	

GeoProc 2015 Organizing Chairs

Dr. Robert Podgorney, Idaho National Laboratory

Dr. John McLennan, University of Utah

Dr. Hai Huang, Idaho National Laboratory

Dr. Milind Deo, University of Utah

GeoProc 2015 Logistics

Jodi Grgich, Idaho National Laboratory

